

open a fissure in the crust, from a fountain of water to the ocean of fire, then the water being suddenly converted into steam, with not room enough in which to expand, other shocks will follow, attended by upheavals, earthquake waves and volcanic disturbances. These will continue for a shorter or longer period, and be slight or heavy, according to the amount of water precipitated, the size of the fissure and other conditions.

There is another factor belonging to the chain of causes which produce earthquakes, in my opinion, which I do not find mentioned by scientists, and yet I think important. If I am in error no harm can result from alluding to it, whereas, if correct in my hypothesis, science may be benefited. Therefore, I will submit it for the consideration of those who are greatly my superiors.

Our present ideas of gravitation were suggested by Sir Isaac Newton, who maintained that every atom of matter in the universe was attracted by, and gravitated towards, every other atom of matter, in accordance with certain fixed laws. Kepler and Newton suggested the idea of centripetal and centrifugal forces, the latter force tending to propel the earth through space in a straight line, the former (the attraction of the sun) tending to propel, or draw, the earth away at a right angle from the direction of the latter. These two forces acting concurrently, the result is the earth moves in a curve, a sort of compromise direction, around the center, or sun.

It frequently happens that the superior planets of our solar system arrive near a conjunction with each other. In such a case all the force of this attraction is exerted to draw our earth out of her orbit towards them, but fail in consequence of being unable to overcome the centripetal force. Now, if gravitation is a truth, the conclusion is unavoidable that there is a powerful tension exerted upon the earth's crust. The next deduction is equally conclusive—namely, that a cracking of the crust, in some place where it is weak, is likely to occur. Finally, it is within the bounds of probability that this yielding of the crust may open a seam through which water can descend to the fire, and then an earthquake results. On several occasions I have observed that earthquakes have been coincident with the configurations of the planets, as before described, and have been successful in predicting earthquakes by calculating the times of their conjunctions. In January, 1871, I wrote to "Uncle Rufus" Hatch, predicting many events to occur in June and July, and among them an earthquake in the vicinity of New York city. I still have his letter, written after the time had elapsed, in which he states that the earthquake came off (but ten days too soon), and was the heaviest known for many years. Since then I have made similar predictions upon the same data, but they have proved total failures. I am now of the opinion that earthquakes may occur when there is no marked conjunctions of the planets. Also, that there may be a marked conjunction at a time when there does not happen to be a place in the earth's crust so weak as to be fractured, and then, of course, no earthquake will result. Still I have confidence

in my hypothesis that it is a factor in the great chain of causes that operate to produce earthquakes.

I have dwelt somewhat at length on earthquakes and volcanic disturbances, because without a general idea concerning them it is impossible for the non-scientific reader to have an intelligent understanding of the *modus operandi* by which the giant forces in Nature have been at work on the earth's crust, preparing it as an abode for man. And this evolution, so sublimely grand, is still going on.

I have been a teacher for more than forty years, and have learned that relaxation is of great advantage to students. So I will indulge in a little intellectual recreation, giving free scope to the wings of fancy, while I try to picture, in the poetry of prose, how this earth came into existence.

First, let us take the highway of science and travel back through the untold eons of time. We are poised in space near the Pleiades ("seven stars"), in the constellation Taurus. Robed in the brightest garments of imagination, with eyes that are telescopic, having the wings of an angel, we start from Taurus, fly at the rate of a million of miles a minute, and yet years must elapse before we can reach the boundaries of what is now our solar system. We arrive here. All is void. There is no sun, no moon, no earth nor sister planet. Gas and vapor are everywhere, but solids and liquids nowhere. Millions of ages before there had been a central orb and its train of worlds, a heavenly battalion wheeling through space with a speed that almost defies the power of thought. But the bounds of their existence had been fixed. One by one, as their hour of dissolution arrived, the planets returned to the central orb—the parent that gave them birth. As they impinged upon her disc there was a report, a flash, and in the wink of an eye each had been dissolved into its original primates, molecules, atoms and gas. Then, by the operation of an infinite force, a property of the parent planet, the great central orb was also dissolved, and we are gazing in imagination upon the empty void in boundless space.

What an awful space lies before us! Our eyes, though telescopic, cannot pierce it. No brain can comprehend its immensity. Silently reposing, like the storm forces before a cyclone, a sea of wasteful, gaseous matter, more than a hundred thousand million miles in diameter, floats in space. Intensely heated by the awful catastrophe which dissolved the old worlds, all the metals and minerals, all the fluids and solids, float lazily in clouds of vapor. They have been cooling for millions of years, yet their heat is still intense.

But now, while we are gazing upon this ruinous waste, the cooling process condenses a single atom. We see it not, nor can we without the aid of a microscope that magnifies hundreds of diameters. Condensation goes on. The atom, like a cell, begins to multiply. A nucleus is formed and slowly increases in size. The nebulous matter flows steadily towards it. Now we can see it—the smallest speck possible to perceive. It is revolving and has polarity. As the windmill revolves under the action